The volume of one mole of any gas at room temperature and pressure is 24 dm^3

1 What is the volume of 0.50 moles of hydrogen gas (H_2) at room temperature and pressure?

volume of H_2 = 24 x moles = 24 x 0.50 = 12 dm^3

2 How many moles in 1.8 dm^3 of helium gas (He) at room temperature and pressure?

moles of He = $\frac{volume}{24}$ = $\frac{1.8}{24}$ = 0.075 mol

3 What is the volume of 7.0 g of nitrogen gas (N_2) at room temperature and pressure?

moles of N_2 = $\frac{mass}{M_r}$ = $\frac{7.0}{28}$ = 0.25 mol

volume of N_2 = 24 x moles = 24 x 0.25 = 6 dm^3

4 What volume of oxygen gas reacts with 100 cm^3 of butane gas, with both gases measured at the same temperature and pressure?

$$2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l)$$

volume of O_2 = $\frac{13}{2}$ x moles C_4H_{10} = $\frac{13}{2}$ x 100 = 650 cm^3

5 What volume of hydrogen gas, measured at room temperature and pressure, is formed when 6.9 g of sodium reacts with water?

$$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$$

moles of Na = $\frac{mass}{M_r}$ = $\frac{6.9}{23}$ = 0.30 mol

moles of H_2 = = $\frac{1}{2}$ x 0.30 = 0.15 mol

volume of H_2 = 24 x moles = 24 x 0.15 = 3.6 dm^3